TITLE: **Food safety and the contract catering companies: food handlers, facilities and HACCP evaluation**

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ABSTRACT

The evaluation of implementing the HACCP system in contract catering companies and assessment of the knowledge, attitudes and practices of the food handlers were the main objectives of this study. It was conducted in 20 companies throughout Spain, with visual inspection of facilities and food handler activities, as well as the distribution of a self-administrable questionnaire among the 105 participant catering workers. In addition, samples of surfaces and finished dishes were taken from each kitchen for microbiological evaluation. The results obtained from the questionnaires reflect extensive knowledge and correct behaviors among respondents with a middle- or high-school educational level, stability in the same workplace and positions of greater responsibility. However, the observation of hygiene practices revealed systematic incorrect procedures in 60% of the kitchens. Most observed deviations were related to the lack of HACCP training and information, the temperature of finished dishes, the storage areas and proper cleaning and disinfection. In summary, this study confirms the difficulties inherent in catering companies to effectively implement the HACCP system, such as the lack of well-trained personnel, lack of motivation or adhesion to said system on the part of the workers, and the lack of financial and economic resources to address

the deficiencies in the facilities. Specific educational programs and grants are need for an adequate implementation of HACCP in this sector.

KEYWORDS: Catering, Food safety, Food handlers, HACCP, Facilities

1. Introduction

The catering business provides food and beverages to people and covers all sectors of society such as childcare, schools, hospitals, businesses, nursing homes (Kinton, Ceserani, & Foskett, 1994). This industry has grown quite strong and undergone profound changes in recent years. According to the European Federation of Contract Catering Organizations (FERCO), approximately 33% of firms or collective organizations currently have a contract with a Contract Catering company (FERCO, 2009). Many factors have contributed to this circumstance, including lifestyle changes, the increase of travelling for business and pleasure, the increase of purchasing power and the increase of elderly people in nursing homes (Anonymous, 2008; Araluce, 2001). However, theses changes have not been accompanied with an improvement of food safety, as shown by the 22% of outbreaks in Europe that have had their origin in processed foods and/or in the distribution by catering establishments (Chapman, Eversley, Fillion, MacLaurin, & Powell, 2010; Jones, Parry, O'Brien, & Palmer, 2008; Tirado & Schmidt, 2001), and by the fact that 54.7% of the total outbreaks in Spain during the period 2004-2007 were related to the catering businesses (Hernández, 2008). Due to the number of people affected annually and the economic losses that are caused, foodborne diseases still continue to be a major public health concern in developed countries (Cates et al., 2009; Scharff, McDowell, & Medeiros, 2009; Senior, 2009; WHO, 2007; Medeiros et al., 2004; WHO, 2004).

In order to reduce the number of foodborne outbreaks, a new regulatory framework for food production and food safety has been developed over the last few years. While in earlier years the main activity regarding risk management was limited to monitoring the final prepared meal, the current national and international regulations comprehensively affect the entire food production process, from the reception of raw materials to the serving of dishes. The White Paper on Food Safety is an essential element in this strategy (EC, 2000). The guiding principle of this policy document states that food safety should be based on a comprehensive and integrated approach so that all food chain participants, including food handlers, are responsible for ensuring food safety. In order to achieve and implement this principle, the so-called "hygiene package" was developed. It includes the Council Regulations (EC) 43/93 and 852/2004 on the hygiene of foodstuffs, to ensure the hygiene of foodstuffs at all stages of

production process. Thus, the restaurant and catering businesses must comply with general hygiene requirements and assume the obligation to implement and maintain permanent procedures based on Hazard Analysis and Critical Control Point (HACCP) principles (CAC, 2003).

According to this legislation, HACCP has emerged as the mainstay in the catering services to ensure safe food preparation following a precautionary basis, by identifying hazards throughout the production process and establishing preventive measures. International organizations as the World Health Organization (WHO), the United Nations Food and Agriculture Organization (FAO) and many countries, with particular reference to the European Union through the publication of the European directive on the hygiene of food products (EC, 1993), promote and foster the implementation of HACCP in the food industry in general and in the catering sector in particular. The key is to determine correctly critical control points (CCP) and how to control them. This requires a hazard analysis in each company for the determination of these CCPs in each process, using the decision tree tool in this selection (Bryan, 1996). However, to ensure effective implementation of HACCP it is necessary to rely on an appropriate system of prerequisites (Mortimore & Wallace, 2001), a documented system that describe activities regarding good hygiene practices to achieve effective management of food safety (Sneed, Strohbehn, & Gilmore, 2004; Wallace & Williams, 2001; Worsfold, 2001). The Recommended International Code of Practice General Principles of Food Hygiene (CAC, 2003) indicates that "Prior to application of HACCP to any sector of the food chain, that sector should have in place prerequisite programs such as good hygienic practices according to the Codex General Principles of Food Hygiene, the appropriate Codes of Practice, and appropriate food safety requirements".

It is known that the implementation and continuous application of the HACCP system in small and medium enterprises of catering is quite difficult, due to the variety of dishes that are prepared, the limited human resources, the majority of the unskilled workers, and in many cases, inadequate and obsolete facilities among other barriers (Taylor, 2006; Sun & Ockerman, 2005; Seward, 2000). Therefore, different studies have led to a more flexible system in this sector (Taylor, 2008a; Worsfold & Worsfold, 2005; Henroid & Sneed, 2004; Sneed, Strohbehn, & Gilmore, 2004; Ramírez Vela & Martín Fernández, 2003; Gilling, Taylor, Kane, & Taylor, 2001). Among them, it must

be mentioned the new method of Applying HACCP designed specifically for caterers, and evaluated and validated by the UK Food Standards Agency (FSA). This method was published as *Menu-Safe* and can be used by catering businesses of all types and sizes (Taylor, 2008a). Its shortened version, *Safer Food Better Businesses* (SFBB), has been developed by the FSA for very small catering businesses.

Thus, the overall objective of this study was to identify weaknesses in food safety management in small catering companies, through the evaluation of the knowledge and attitudes of food handlers, the adequacy and cleanliness of facilities, and the difficulties for implementation of HACCP in one sample of this sector in Spain, with the aim to develop an adapted HACCP method for Spanish catering companies, based on the premises of *Menu-Safe* and SFBB.

2. Material and Methods

2.1 Sample selection

In order to perform the selection of kitchens for the study, we contacted the main social catering companies in Navarre (Spain) and neighboring provinces. A letter explaining the purpose of the study and requesting cooperation was sent to each company. In addition, confidentiality of the information gathered was ensured. Twenty companies agreed to participate in the study.

2.2. Documentation design

A self-administrable questionnaire was developed in order to evaluate the knowledge and assumed behavior of food handlers. The questionnaire consisted of a first set of general questions (age, sex, educational level, years worked in this sector, current position in the company, and the training received), followed by 26 multiple choice questions related to food safety and HACCP (temperature of storing and cooking foods, hand washing, cleaning and disinfection, spread and multiplication of microorganisms, etc). The last part included questions to determine employee work satisfaction in relation to their duties and their training in food safety.

The questionnaire was evaluated by four experts in the field of food safety and HACCP, which confirmed that relevant aspects to assess knowledge and assumed behavior were included, as well as the comprehension and language used in each of the questions. Furthermore, the questionnaire was pre-tested by two groups of subjects: the first one was formed by experienced food handlers from the catering sector, and the second, by subjects not related with this sector. The number of correct questions was higher in the first group. Finally, we conducted a pilot test in which a different selection of food handlers was asked to rate the degree of understanding of proposed questions and options to answer. The results showed the adequacy to the questionnaire, and there were no observations to improve the document.

In addition, a template was designed to collect data through visual inspection regarding food handlers (staff uniforms, no jewels, hygienic practices, etc) and facilities (storage areas, cooking areas, etc), as well as through interviewing the person responsible with regard to HACCP aspects (manual of procedures, temperature records, etc).

2.3. Visiting the facilities: data and sample collection

The visits to the kitchens were conducted when the food handlers were doing their daily tasks. First, we proceeded to collect information by direct observation, interview the manager or person in charge at the time of the visit, and distribute questionnaires among staff handlers. The respondents completing the questionnaire remained anonymous and were identified by job description. Each questionnaire took approximately 15 min to complete, and 105 persons participated from January to May 2010.

Next, we proceeded to sample surfaces and prepared dishes during the workday, in order to assess hygiene practices and culinary treatments through microbiological testing. In every kitchen, 5 clean surfaces were tested by gently pressing the agar of contact plates PCA (Biomerieux, Marcy l'Etoile, France) on the surface in order to evaluate: chopping board, knife or slicer whisk, scoop or spoon, and tray or other sources of service. In addition, at least two samples of meals prepared that day were collected, including hot and cold dishes (first and second courses, crushed in processed food, salads, chilled desserts, etc.). Food sampling was performed under sterile conditions, measuring the temperature in the center of the product at the time of collection (Thermometer Foodcare Hanna Instruments, Eibar, Spain).

2.4. Microbiological testing

The samples collected were transferred under refrigeration to the Laboratory of Food and Microbiology of the University of Navarra, and microbiological tests were performed within 2 hours from their arrival. PCA contact plates (Biomerieux) were incubated at 30±1ºC for 72±3 hours, and the result expressed in CFU/25cm^2. Counts equal or below 50 CFU/25 cm^2 were considered satisfactory.

Regarding food samples, investigation of *Salmonella* spp and *Listeria monocytogenes* was performed according to ISO 6579 (Anonymous, 2002) and NF EN ISO 11290-1/A1 (Anonymous, 1997; Anonymous, 2005), respectively.

2.5 Statistical analysis

Descriptive statistics were performed using statistical package SPSS version 15.0 (SPSS Inc., Chicago, Illinois, USA). Chi-square test was used to assess differences for

proportions between groups. All P values are two-tailed and statistical significance was set at the conventional cut-off of $P < 0.05$.

3. Results

3.1. Evaluation of food handlers

Most of the 105 employees taking part in the study were female (87.6%), with Spain being the main country of origin (93.1%). The average age was 43 (SD±9) and the educational level of almost half of the respondents (44.7%) was primary school. They had worked in food catering industry for more than 10 years (62.5%), with a frequent change of job (59.8% had worked in 3 or more companies) and position (only 36.1% maintained the same post within 10 years).

Table 1 shows the level of knowledge and reported behavior regarding different aspects of food safety. The percentage of correct answers was ≥90% in 11 questions out of 15. There were highly significant differences in all responses ($p<0.001$). However, 64.8% of respondents failed to correctly respond to question 8, regarding good practices of cooking. We found better answers among food handlers with middle or higher education, and among these, those in positions with greater responsibility (10 out of 15 questions) scored higher. In addition, respondents that had worked 10 or more years in the catering sector had obtained the best scores, especially those having worked more years in the current company and the current position (12 out of 15 questions) (data not shown).

With regard to the evaluation of work satisfaction, the majority of answers were positive. However, over 20% of the respondents reported that they are not informed regarding their responsibilities and they think that training in hygiene and food safety is insufficient and/or repetitive. In addition, more than 30% are never involved in the decisions that directly affect their job and are not usually supervised in their routine task. It must be mentioned that 85% of food handlers missed regular meetings set up for the entire staff, providing more information about the work development and customer satisfaction.

Observations made during the visits showed that in only 10% of the kitchens food handlers wore the correct uniform, and the following deficiencies were detected: missing cap (85%), presence of jewelry (60%) and unavailable masks (50%). With regard to the hygienic practices observed, hand washing and use of kitchen cloths were adequate in 60% of the kitchens, but deficiencies were detected in the treatment of food leftovers, in defrosting practices and in vegetable disinfection procedures (this last deficiency being observed in 95% of the kitchens).

3.2. Evaluation of facilities

The majority of the kitchens studied (80%) were managed by external companies, mainly in the school sector (45%), followed by the sanitary sector (25%) and business companies (15%). More than half of them (60%) had a daily production between 100 and 499 menus.

With regard to the visual examinations, 75% of the establishments were considered correct in terms of order and cleanness, despite the fact that we found a lack of sinks in several areas (95%) and deficiencies in 50% of restrooms and changing areas (lack of showers or hot water). However, the principal deviations were found in reception and storage areas. In this sense, 85% of the kitchens had no specific area for reception tasks, including specific scales and thermometer to check temperatures of raw materials. With regard to storage, 70% of the refrigerators, 35% of the freezers and 40% of the room temperature storage rooms had insufficient capacity, inadequate lighting or unprotected shelves. In addition, the storage of nonperishable products was incorrect in 100% of the analyzed storage rooms due to the presence of products in contact with the soil, or because there was no separation between food and cleaning products.

3.3. HACCP system evaluation

Information provided by the person in charge of each kitchen showed that there was an HACCP system established in all of the kitchens studied. However, recovered data confirmed that the implementation of these systems was incorrect in 70% of the kitchens, despite the fact that all of them had a manual on HACCP procedures. The principal weaknesses were the lack of guides for good hygienic practices and incomplete prerequisites programs (95%), or the noncompliance with the established system to record activities (50%). Only 45% of the kitchens were successful in procedures and in the recording of dish temperatures.

It must be pointed out that only 41.9% of people interviewed were informed and/or trained regarding HACCP, despite the fact that 79% of them considered implementation of this system to be necessary in order to ensure food safety, and almost 90% affirmed that the HACCP is implemented in their kitchens (Table 2).

3.4. Microbiological evaluation of surfaces and dishes

At least one of the sampled surfaces exceeded the established limit in 85% of the kitchens (Table 3), with more than half of analyzed samples being incorrect in 15% of the establishments. The negative results obtained in kitchen number 18 stand out, as we found counts >50 CFU/25 cm^2 in all of the equipment and utensils tested. The dirtiest surfaces were blenders or cutting machines, with 50% of them exceeding the limit value. On the other hand, our analysis showed that 90% of the service trays and 70% of the knives, skimmers and cutting boards had correct values.

Microbiological analysis of dishes showed the absence of *Salmonella* spp and *L. monocytogenes* in 25 g of all samples. However, the temperature records of 32.1% of hot dishes were below the limit established by law (65ºC), and two of them showed values below 55ºC (Table 4). In addition, 80% of the cold dishes were not properly refrigerated, exceeding 8ºC.

4. Discussion

Since food safety remains a critical issue in the catering industry, the Council Regulation 852/2004 on the hygiene of foodstuffs (EC, 2004) requires all food businesses to implement a system based on HACCP principles. Evaluation of the implementation of this system in 20 food catering companies was one of the objectives of this study.

The starting point for the correct implementation of the classical HACCP system is the involvement of all personnel in the HACCP methodology and philosophy. Our study has shown that 15% of food handler responders did not know whether or not the system was implemented, and more than half of them claimed that they had not received a sufficient amount of information on the subject. These results are consistent with the first of the 21 barriers identified by Taylor (2008b), classified as knowledge barrier (lack of HACCP awareness). According to the new and flexible method proposed by Taylor (2008c), there is no requirement for caterers to be aware of or to have any knowledge of HACCP in order to develop and implement the system. However, to achieve the successful implementation of HACCP, the concept must be understood first, by the managers of the establishments (FAO/WHO, 2006). Their understanding and involvement are essential to define responsibilities and tasks for each staff member, and to provide specific training for each one of them.

Lack of employee motivation is one of the most frequently barriers identified to implement an HACCP based food safety management system (Taylor, 2008b; Bas, Yüksel & Cavusoglu, 2007; FAO/WHO, 2006; Taylor & Kane, 2005). Ramírez Vela and Martín Fernández (2003) refer to a lack of motivation among food handlers as the main cause of system failure. In addition, Taylor (2008b) identifies other psychological barriers such as lack of agreement and lack of self-efficacy. Similarly, in our study we found some attitude barriers due to a lack of educative courses, sessions or meetings, making it more difficult for workers to adhere to this system. We suggest the possibility of holding regular meetings with all staff members present in order to collect first-hand views regarding work progress, and to involve them in the decisions made in relation to the implementation of HACCP. This greater involvement of the workers would result in a greater satisfaction on their part and consequently, produce better work attitudes. According to the answers given by participants, along with the need to improve training, there is a need to improve supervision by managers. Taylor (2008b) claims that the lack

of management control is one of the most important behavioral barriers to a successful implementation of HACCP. Not all managers are involved in the system and not all of them assigned appropriate responsibility to staff. Therefore, increased management involvement, communication and supervision will result in greater employee motivation.

With regard to workers evaluation, the results obtained from questionnaires exhibit a high level of knowledge and assumed behaviors on the part of respondents. These results were slightly better among people who had a middle- or high-school educational level and for those who had worked 10 or more years in the catering sector. Stability in the same workplace and positions of greater responsibility also had a positive influence in the answers. These results coincide with those obtained by several authors (Çakiroglu & Uçar, 2008; Angelillo, Viggiani, Rizzo, & Bianco, 2000), and they reveal that food handlers learn more throughout their professional lives by repeatedly hearing the theoretical basics of hygiene and food handling, and by becoming more involved in the different daily tasks (Bolton, Meally, Blair, McDowell, & Cowan, 2008; Angelillo, Viggiani, Greco, & Rito, 2001). However, we found an important lack of knowledge regarding lethal temperature for microorganisms and the maximum time for maintaining dishes at room temperature after cooking, even in the food handlers with a higher educational level. This data is consistent with that reported in the study carried out by Bas (Bas, Ersun, & Kivanc, 2006), which warns about the lack of basic knowledge regarding food hygiene and in particular, critical temperatures. In a similar way, Taylor (2008b) found that even the most skilled caterers in the hospitality industry often revealed at least one area where their knowledge of food safety was lacking, and as a result, the lack of food safety knowledge was listed as one of the 21 barriers.

However, the scores obtained from the food handler questionnaire should be viewed with caution. As it has been pointed out by several authors, responses related to knowledge are often based on "what should be or become" rather than "what really makes", so they propose to conduct observational studies (Tokuç, Ekuklu, Berberoglu, Bilge, & Dedeler, 2009; Fischer et al., 2007; Gilbert et al., 2007). In this sense, our questionnaire showed that 98% of the staff knows how to perform the correct disinfection of raw vegetables, while our observation of hygiene practices revealed systematic incorrect procedures in 60% of the kitchens. In addition, the unnecessary permanence of food at room temperature, as well as the incorrect practices observed in more than 95% of kitchens regarding the storage of raw material, confirmed the fact that

while the workers are very knowledgeable in theory with regard to hygiene, very few actually carry it out in practice; also, the workers have very scare appreciation of the risks involved. Other relevant information provided by the visual examination of facilities showed the deficiencies found in the reception area of raw materials (no specific area allocated) and storage areas (insufficient), which could lead to cross-contamination (Walker, Pritchard, & Forsythe, 2003a). In our opinion, one of the reasons for the poor conditions of the facilities is based on the fact that 80% of the evaluated kitchens are managed by external companies, which usually do not invest in improving installations due to the uncertainty factor regarding the contracts. These observations support barrier 14 (lack of resources) described by Taylor (2008b), which refers to the lack of space, equipment, staff, money and time in most of the establishments that are investigated.

One of the major problems detected when HACCP systems were investigated was the absence or incompleteness of prerequisite programs (95% failures), as well as guides for good hygiene practices. Several authors promote their use as an assurance that the HACCP system has begun to be effective (Bas et al., 2005; Walker, Pritchard, & Forsythe, 2003b; Wallace & Williams, 2001). In this present study, most observed deviations were related to temperature control of raw and processed foods and proper plans for cleaning and disinfection, despite the fact that both aspects were considered basic CCPs in the HACCP studied systems. These observations confirm the need to improve education in the basic pillars of hygiene practices, in order to understand the goal of HACCP implementation and the adequate selection of CCPs to ensure food safety. With regard to retention temperatures of prepared meals, we found important deviations from the established limits in Spanish legislation (BOE, 2001). In order to define the necessary corrective measures to be applied in case of deviation from the limits, it is very important to have as much information as possible. In this sense, experiences in the catering sector point out the difficulty of maintaining 65°C in temperature in foods that have easily lost it (fried, grilled, rice, pasta, fish, etc). In our study, 28.6% of the dishes showing temperatures between 64ºC and 55°C belonged to this group of foods. Therefore, we consider appropriate the proposal of Bryan et al. (1980), with a desirable temperature limit (≥65°C) and a tolerable level (≥55°C) to be successful. In a similar way, the International Commission on Microbiological Specifications for Foods (ICMSF, 1991) indicates 55ºC as the low temperature limit for

hot dishes. More recently, the "5 Keys Manual" published by WHO (2006) indicates ≥60ºC for temperature retention of hot dishes. However, retention temperatures below 55ºC seem to be an unacceptable risk, and it would be necessary to perform corrective actions to prevent recurrence of these results.

On the other hand, the prerequisite program establishes the need for a proper daily cleaning program and a monitoring system for checking the related CCPs. Typically, this monitoring is carried out by direct observation, although regular microbiological checks using contact agar plates are recommended because they provide more accurate and objective data (Kassa, Harrington, Bisesi, & Khuder, 2001). Since there are no established limits (CFU/cm^2) for considering a surface to be clean in the catering industry in Spain, an evaluation of cleanliness of utensils and equipment was performed, using the acceptable limit of ≤50 CFU/25cm^2 based on reference literature (Moragas & De Pablo, 2010; Forsythe & Hayes, 1998; Nortje et al., 1990; Orefice, 1984; Patterson, 1971) and our laboratory experience (more than 3000 surface samples analyzed). According to Irigoyen and García-Jalón (1992), the dirtiest surfaces in our study were the blenders and the cutting machines (50% exceeded the limit), so it is necessary to implement and/or improve control measures in these CCPs in order to prevent cross-contamination or spread of microorganisms (Hernández, 2008). Despite all tested meals complying within the safety criteria established in the regulations (absence of *Salmonella* and *Listeria monocytogenes*), there is a need to extreme vigilance in founded deviations.

In short, this study confirms the existence of inherent barriers in catering companies to effectively implement the HACCP system, already reported by other authors (Taylor, 2008b; Bas, Yüksel, & Cavusoglu, 2007; Gilling et al., 2001), including knowledge barriers (lack of awareness and food safety knowledge), psychological barriers (lack of motivation and adhesion to the system) and operating barriers (lack of resources and management control). However, if we recognize HACCP as a basic working tool in the catering industry, a more flexible system should be applied for a successful implementation in this sector. Thus, the new method of applying HACCP for caterers and food service industry (Taylor, 2008a), could be adopted by the Spanish contract catering companies, with the development of appropriate materials and easier records. Our next step we will be to interview those in charge of catering facilities in order to learn why the implementation of HACCP systems was so weak despite the relatively

good food safety knowledge reported. Supervisors appear to play a key role in the success of the system; therefore, the monitoring of activities must be improved.

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Table 1. Food safety knowledge and behavior questions

Questions	Total responses (n)	Correct responses (%)
(Q1) How do you usually defrost food in your workplace? Leaving them in the kitchen at room temperature; **in the refrigerator**[a]; using cold water; using the microwave	104	94.3
(Q2) Circle the correct temperature of the refrigerator and freezer, respectively -2ºC and -20ºC; 10ºC and -20ºC; 0ºC and -18ºC; **between 1 and 5ºC and -18ºC**	105	90.5
(Q3) How long can food be at room temperature after cooking it? **maximum 2 hours before storing it in the refrigerator**; until the food cools in order to avoid damaging the refrigerator temperature control; at least 4 hours before storing it in the refrigerator; for whatever length of time you wish	95	74.3
(Q4) To improve the effectiveness of cleaning and disinfection detergents and disinfectants should be mixed according to your own criteria; it is recommended to use more quantity of product than what the manufacturer indicates; **do not mix products and use the exact dose recommended by the manufacturer**; there is no need to use disinfectants because the action of a detergent is sufficient	104	98.1
(Q5) If you have leftover food, in which area of the fridge do you store it? wherever possible; always at the bottom because the upper area is for raw food; **in the top area and always covered**; **I never store leftovers**	105	96.2
(Q6) What must be taken into account when preparing vegetables that will be eaten raw? they should be disinfected by adding bleach to the water; they should be left at room temperature so that they are not cold at the time of consumption; nothing special needs to be taken into account as they are only vegetables; they should be **disinfected by adding the amount of bleach considered to be appropriate for vegetables to the water**	105	98.1
(Q7) How do you usually test meals in your workplace? all meals are tested with the same spoon; with hands if they are clean; **with a different clean spoon for each of the dishes**; the way of testing is not important	105	99.0
(Q8) The minimum cooking temperature needed for killing the majority of microorganisms is 45ºC measured on the surface of the food; 80ºC measured at the	102	35.2

center of the food; **70ºC measured at the center of the food**; 100ºC measured on the surface of the food		
(Q9) Regarding the sampling of dishes that are made:	104	96.2
All dishes must be sampled every day; there is no need to take daily samples of the dishes; samples can be taken after the left-over food is returned; sampling only needs to be done when they are hot dishes		
(Q10) In what way and where must be garbage cans be placed in the kitchen?	105	98.1
near handling areas and open to facilitate the work; it does not matter where they are placed as long as they do not disturb traffic areas; **they should always be covered and operated**; its best to have the least number of garbage cans in the kitchen		
(Q11) Under current legislation, food should be defrosted **in the refrigerator**; at room temperature; using cold water; using hot water	105	99.0
(Q12) At what temperature do bacteria multiply the fastest?	104	94.3
5ºC; **37ºC**; 65ºC; 100ºC		
(Q13) Do you take the temperature of meals when you finish making them?	102	87.6
yes, always; no; sometimes, whenever I remember; **I do not take the temperature, another person is responsible for this task**		
(Q14) When do you wash your hands with hot water and soap and dry them with paper towels?	102	93.3
when I have time; only when I have dirty hands; **when the company establishes it**; **when I change activities or use the toilet**		
(Q15) What should the serving temperature of dishes be?	101	77.9
hot dishes above 80ºC and cold food below 20ºC; **hot dishes above 65ºC and cold food below 8ºC**; hot dishes above 50ºC and cold food below 5ºC; I do not know		

[a] Options in black are considered to be correct answers (one or more options)

Table 2. Food handler questions regarding HACCP system

Questions	Total responses (n)	Yes (%)
(Q21) Is the HACCP system implemented in your kitchen?	101	87.6
(Q22) Have you been informed as to what HACCP means?	99	41.9
(Q23) Do you think that HACCP is important for food safety?	99	79.0
(Q24) Do you record operations during your daily job?	100	94.2
(Q25) Do you think prerequisites are needed for HACCP?	98	45.7

Table 3. Evaluation of surface cleaning and disinfection (CFU/25 cm^2)

Kitchen	Surfaces				
	Knife	**Skimmer**	**Cutting board**	**Service tray**	**Cutting machine/Blender**
1	1	24	17	4	>100
2	1	12	0	2	3
3	4	9	0	0	55
4	>100	4	>100	0	3
5	6	2	0	27	0
6	6	1	48	0	55
7	49	1	18	3	80
8	63	3	27	14	27
9	0	10	>100	27	84
10	35	4	29	6	>100
11	20	0	0	25	45
12	35	1	46	>100	70
13	18	74	18	17	28
14	68	62	>100	0	20
15	53	1	30	0	44
16	39	110	104	20	93
17	20	77	16	3	14
18	>100	68	102	69	111
19	119	9	0	2	4
20	3	5	32	9	93
Incorrect	30%	25%	25%	10%	50%

Table 4. Temperatures of dishes analyzed at the time of serving

Prepared food	Number of dishes	Number of dishes with incorrect temperature (%)
Hot consumption	**56**	**18 (32.1)**
Mixer/Purees	13	2 (15.4)
Fish	12	5 (41.7)
Meat	11	2 (18.2)
Vegetables	10	3 (30.0)
Rice/Pasta	7	4 (57.1)
Other (croquettes, etc).	3	2 (66.7)
Cold consumption	**10**	**8 (80.0)**
Lettuce	5	3 (60.0)
Dairy desserts	4	4 (100)
Fruit shakes	1	1 (100)
Total	**66**	**26 (39.4)**